Docket No. 36903/SAH/C715

IN THE CLAIMS:

Please cancel claims 2-21.

Respectfully submitted,

CHRISTIE, PARKER & HALE, LLP

By _____
Art Hasan
Reg. No. 41,057
626/795-9900

SAH/rvw
::ODMA\MHODMA\CPHPAS;228686;1

#5/44
T. Bell
3.15.01

152236-0036

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the U.S. Patent Application of:

Inventor(s): Swirhun, et al.

Serial No.: 08/803,891

Filed: 2/21/97

Examiner: L. Pham

Art Unit: 1104

For: A CLOSELY-SPACED VCSEL AND PHOTODETECTOR FOR APPLICATIONS REQUIRING THEIR INDEPENDENT OPERATION

Certificate Of Mailing (37 CFR 1.10)
Express Mail Label No.EM139232887US

December 11, 1997
Date of Deposit

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date shown below and is addressed to the Assistant Commissioner of Patents, Washington, D.C. 20231.

Typed or Printed Name of Person Mailing Paper or Fee

Signature of Person Mailing Paper or Fee

Docket: Pending

PRELIMINARY AMENDMENT UNDER 37 CFR §1.115(a)

Assistant Commissioner of Patents
Washington, D.C. 20231

Sir:

Please enter the following amendments under 37 CFR §1.115(a) in the above referenced application as follows:

In The Claims:

Please cancel claim 1, and add claims 2-39 all as shown below in the full set of all pending claims presented below for the Examiner's convenience.

2. (Newly Presented) A method of manufacturing monolithic VCSEL and photodetector pairs, said method comprising the steps of:

pbck

forming VCSEL layers directly on a semiconductor wafer substrate; then

forming photodiodes distributed across said wafer; and

dividing said wafer into chips including a VCSEL and photodiode pair.

3. (Newly Presented) The method of claim 2 wherein the step of forming VCSEL layers on a semiconductor wafer substrate further comprises:

forming first mirror layers;

forming a first cladding layer on said first mirror layers;

forming an active region on said first cladding layer;

forming a second cladding layer on said active region; and

forming second mirror layers on said second cladding layer.

4. (Newly Presented) The method of claim 3 further comprising the step of:

defining active and inactive VCSELs by forming isolation regions therebetween.

5. (Newly Presented) The method of claim 3 further comprising the step of:

defining active and inactive VCSELs by forming isolation regions around said second mirror layers of said active VCSELs.

6. (Newly Presented) The method of claim 3 further comprising the step of:

defining active and inactive VCSELs by forming proton implant isolation regions around said second mirror layers of said active VCSELs.

7. (Newly Presented) The method of claim 3 further comprising the step of:

defining active and inactive VCSELs by forming proton

layers to said second cladding layer.

8. (Newly Presented) The method of claim 3 further comprising the step of:

forming VCSEL anode contacts on a topmost second mirror layer of said active VCSELs.

9. (Newly Presented) The method of claim 3 further comprising the step of:

forming VCSEL anode contacts overlapping a topmost second mirror layer and said isolation region of said active VCSELs.

10. (Newly Presented) The method of claim 2 wherein the step of forming VCSEL layers directly on a semiconductor wafer substrate further comprises:

first forming a plurality of VCSEL cathode layers directly on said semiconductor wafer substrate.

11. (Newly Presented) The method of claim 2 wherein the step of forming photodiodes distributed across said wafer further comprises:

forming photodiodes directly on said semiconductor wafer substrate at discrete locations.

12. (Newly Presented) The method of claim 11 wherein the step of forming photodiodes directly on said semiconductor wafer substrate at discrete locations further comprises:

first removing said VCSEL layers on said semiconductor wafer substrate at discrete locations.

13. (Newly Presented) The method of claim 2 wherein the step of forming photodiodes directly on said semiconductor wafer substrate further comprises:

forming metal-semiconductor-metal photodiodes directly on

said semiconductor wafer substrate at discrete locations.

14. (Newly Presented) The method of claim 2 further comprising the step of:

forming an antireflective coating on said photodiodes.

15. (Newly Presented) The method of claim 2 wherein the step of forming photodiodes distributed across said wafer further comprises:

forming photodiodes laterally adjacent said active VCSELs

16. (Newly Presented) The method of claim 4 wherein the step of forming photodiodes distributed across said wafer further comprises:

forming photodiodes distributed on said second mirror layers of inactive VCSELs.

17. (Newly Presented) The method of claim 3 wherein the step of forming photodiodes distributed across said wafer further comprises:

forming distributed p-type layers on a topmost second mirror layer;

forming an intrinsic layer on said distributed p-type layers;

forming an n-type layer on said intrinsic layers;

forming a photodiode cathode contact on each of said n-type layers; and

forming distributed photodiode anode contacts on said topmost second mirror layer.

18. (Newly Presented) The method of claim 5 further comprising the step of:

prohibiting operation of said inactive VCSELs by electrically short circuiting said semiconductor wafer substrate

to said photodiode anode contact.

19. (Newly Presented) A method of manufacturing an integrated VCSEL and photodetector pair, said method comprising the steps of:

forming layers of a VCSEL on a semiconductor substrate;

forming layers of a photodiode on a top-most layer of a first portion of said VCSEL layers;

isolating a second portion of said VCSEL layers from said photodiode layers by implanting an isolation region between said first and second portions of said VCSEL layers;

forming a VCSEL cathode contact connected to said semiconductor substrate;

forming a VCSEL anode contact connected to said top-most VCSEL layer in said second portion;

forming a photodiode cathode contact on a topmost layer of said photodiode layers; and

forming a photodiode anode contact on said top-most VCSEL layer of said first portion of said VCSEL layers.

20. (Newly Presented) The method of claim 19 wherein the step of forming a VCSEL anode contact connected to said top-most VCSEL layer in said second portion further comprises:

forming a VCSEL anode contact overlapping said top-most VCSEL layer in said second portion and said isolation region.

21. (Newly Presented) The method of claim 19 further comprising the step of:

prohibiting operation of said first portion of said VCSEL layers as a VCSEL by electrically short circuiting said substrate to said topmost layer of said VCSEL layers in said first portion.

22. (Newly Presented) A monolithic optical transmitter and receiver pair comprising:

a semiconductor substrate;

an optical transmitter formed on said substrate; and

an optical receiver formed laterally adjacent said optical transmitter, said optical receiver optically and electrically isolated from said optical transmitter.

23. (Newly Presented) The device of claim 22 wherein said optical receiver further comprises:

a photodiode.

24. (Newly Presented) The device of claim 22 wherein said optical transmitter further comprises:

a VCSEL having a plurality of layers.

25. (Newly Presented) The device of claim 24 wherein said VCSEL further comprises:

an isolation region defining discrete areas of active VCSEL layers and discrete areas of inactive VCSEL layers.

26. (Newly Presented) The device of claim 25 further comprising:

means for disabling inactive VCSEL layers.

27. (Newly Presented) The device of claim 22 wherein said optical transmitter further comprises:

first mirror layers formed on said substrate;

a first cladding layer formed on a topmost first mirror layer;

an active region formed on said first cladding layer;

a second cladding layer formed on said active region; and

second mirror layers formed on said second cladding layer.

28. (Newly Presented) The device of claim 27 wherein said active region further comprises:

at least one quantum well layer.

29. (Newly Presented) The device of claim 28 wherein said first and second mirror layers further comprise:

epitaxially grown distributed Bragg reflectors.

30. (Newly Presented) The device of claim 22 wherein said optical receiver further comprises:

a photodiode formed on a topmost second mirror layer of said inactive VCSEL layers.

31. (Newly Presented) The device of claim 22 wherein said optical receiver further comprises:

a p-type layer formed on a topmost second mirror layer of said inactive VCSEL area;

an intrinsic layer formed on said p-type layer;

an n-type layer formed on said intrinsic layer;

a photodiode cathode contact formed on said n-type layer; and

a photodiode anode formed on said topmost second mirror layer.

32. (Newly Presented) The device of claim 26 wherein said means for further comprises:

an electrical short circuit between said substrate and said photodiode anode.

33. (Newly Presented) The device of claim 22 further comprising:

a non-reflective coating on said optical receiver.

34. (Newly Presented) The device of claim 22 wherein said optical receiver further comprises:

a photodiode formed on said semiconductor substrate.

35. (Newly Presented) The device of claim 31 wherein said photodiode further comprises:

a metal-semiconductor-metal photodiode.

36. (Newly Presented) An array of monolithic optical transmitter and receiver pairs formed by the process of claim 19.

37. (Newly Presented) An matrix of monolithic VCSEL and photodetector pairs formed by the process of claim 2.

38. (Newly Presented) A monolithic optical transmitter and receiver pair formed by the process of claim 13.

39. (Newly Presented) A monolithic optical transmitter and receiver pair formed by the process of claim 18.

REMARKS

The above claims were added to clearly distinguish the present invention. Applicant respectfully requests that the Examiner allow the claims and pass this case to issue.

Respectfully Submitted,
Irell & Manella LLP

Norman E. Brunell

Norman E. Brunell, Reg. No. 26,533

1800 Avenue of the Stars, Suite 900
Los Angeles, CA 90067-4276

(310) 277-1010
(310) 203-7199 Facsimile
nbrunell@irell.com

pbck